

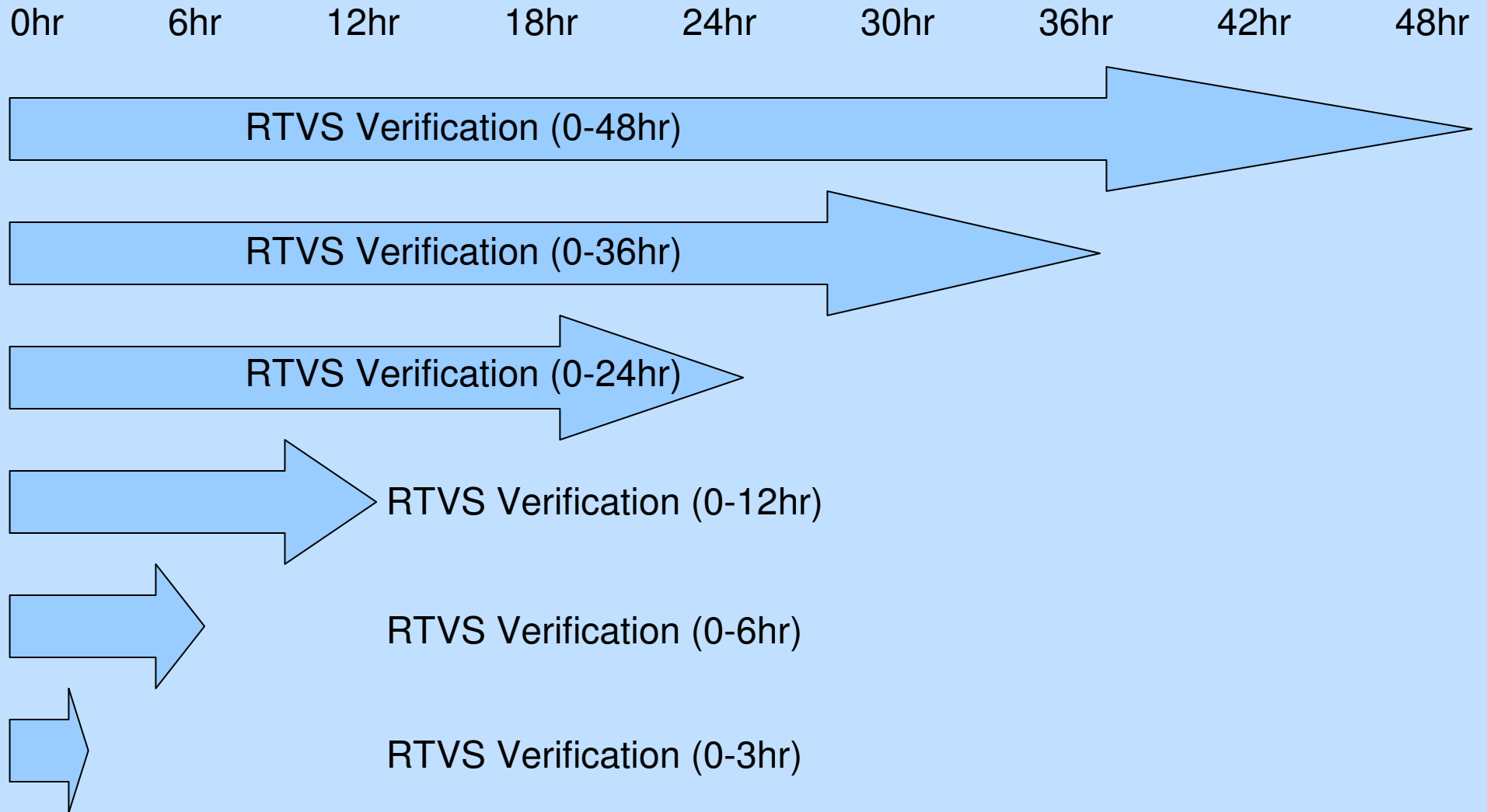
**Why are there differences
between precipitation
verification results from the
grid-to-point system from RTVS,
and the
grid-to-grid system from NCEP?**

Two Precipitation Verification Systems
running at the DTC from January – March, 2005
(DWFE Time Period)

The NCEP system was ported to the DTC through the efforts of Meral Demirtas & Ying Lin	NCEP Precipitation Verification Method	RTVS Precipitation Verification Method
Observations	Daily: CPC 1/8 degree gauge-only (24-h) analysis product 3-hrly: Stage II (radar + gauge)-based analysis product, limited QC	Hourly: HADS gauge data with enhanced QC provided by FSL (this was improved upon in early February following implementation of an advanced QC)
Method	Grid-to-grid: Remap forecast and analysis to common verification grid For DWFE, common grid is the Eta 12km, or the WRF 5km native grid	Grid-to-point: Bi-linearly interpolate forecast values to observation locations
Verification periods	Daily: Performed from 12Z to 12Z (FCST hours 12-36) 3-hrly: Includes only the last 3 hours of the chosen forecast period	Hourly data accumulation: Forecasts and observations accumulated over 0-3, 0-6, 0-12, 0-24, 0-36, 0-48h

RTVS precipitation verification time periods

DWFE Model Runs



NCEP precipitation verification time periods

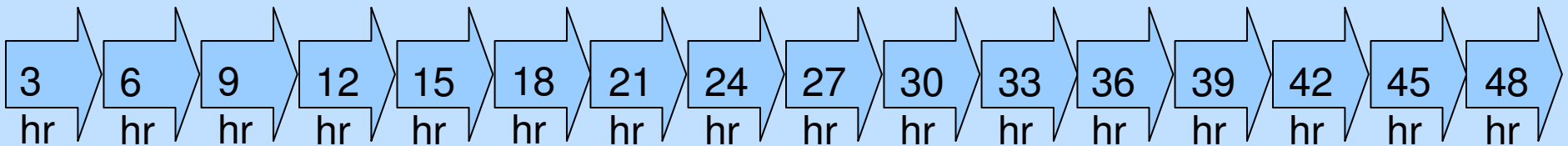
DWFE Model Runs

0hr 6hr 12hr 18hr 24hr 30hr 36hr 42hr 48hr

NCEP Daily Verification (12-36hr)



NCEP 3-hrly precipitation verification:



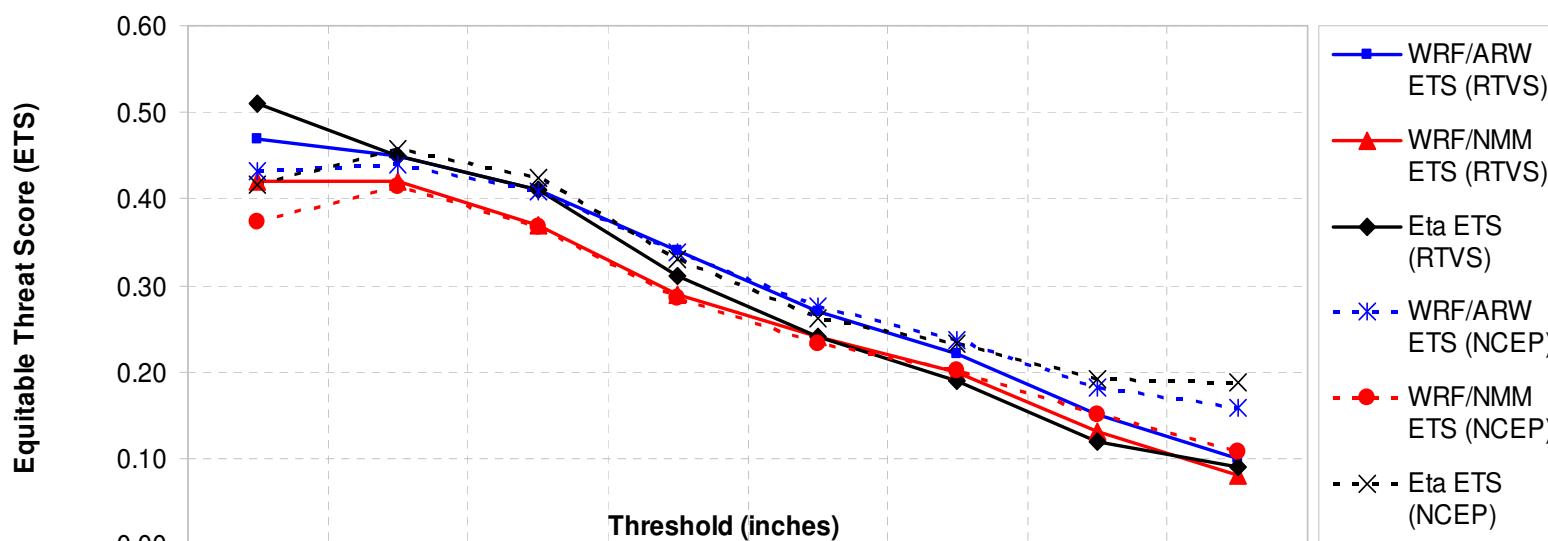
Direct comparison of results from the two systems

RTVS & NCEP Precipitation Verification Results

Entire DWFE domain 15 Jan – 31 Mar 2005

ETS

ETS: JAN 15 - Mar 31, 2005 RTVS & NCEP Precipitation Verification, National Domain



	0.01	0.10	0.25	0.50	0.75	1.00	1.50	2.00
WRF/ARW ETS (RTVS)	0.47	0.45	0.41	0.34	0.27	0.22	0.15	0.10
WRF/NMM ETS (RTVS)	0.42	0.42	0.37	0.29	0.24	0.20	0.13	0.08
Eta ETS (RTVS)	0.51	0.45	0.41	0.31	0.24	0.19	0.12	0.09
WRF/ARW ETS (NCEP)	0.43	0.44	0.41	0.34	0.28	0.24	0.18	0.16
WRF/NMM ETS (NCEP)	0.37	0.41	0.37	0.29	0.23	0.20	0.15	0.11
Eta ETS (NCEP)	0.42	0.46	0.42	0.33	0.26	0.23	0.19	0.19

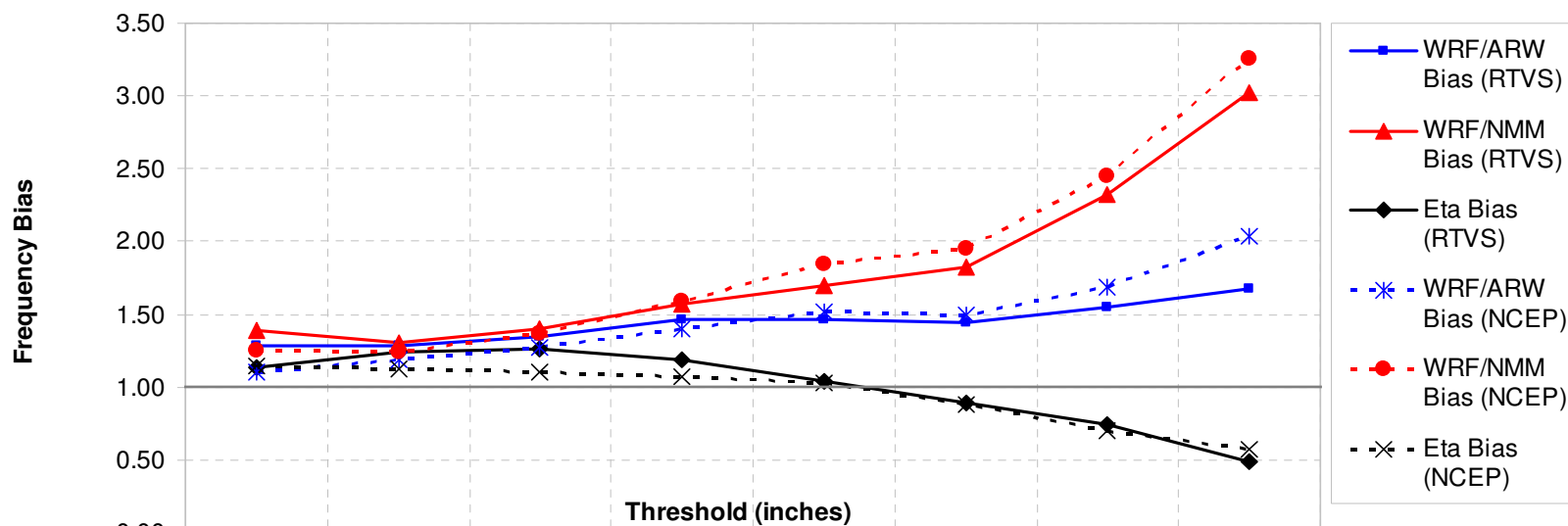
Direct comparison of results from the two systems

RTVS & NCEP Precipitation Verification Results

Entire DWFE Domain 15 Jan – 31 Mar 2005

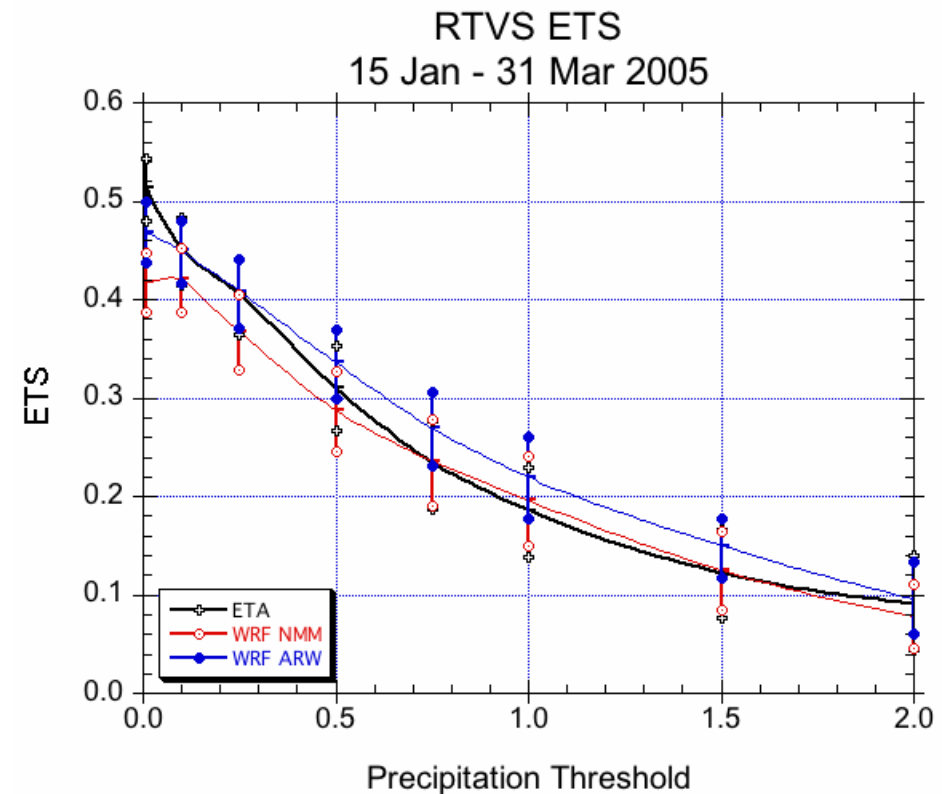
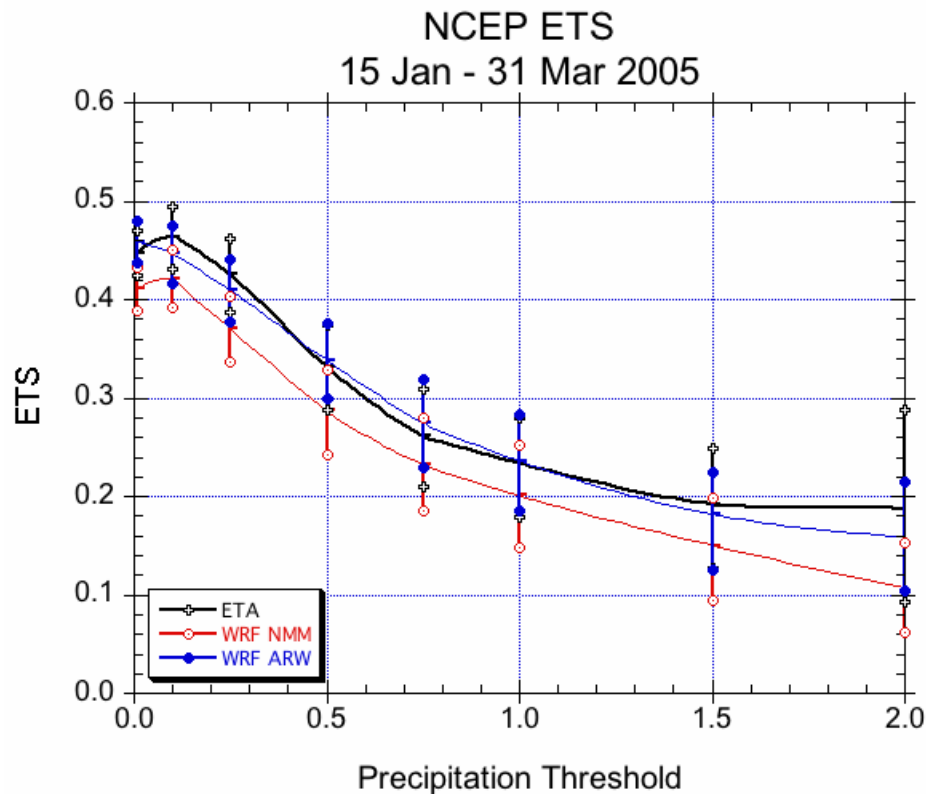
BIAS

Frequency Bias: Jan 15 - Mar 31, 2005 RTVS & NCEP Precipitation Verification, National Domain



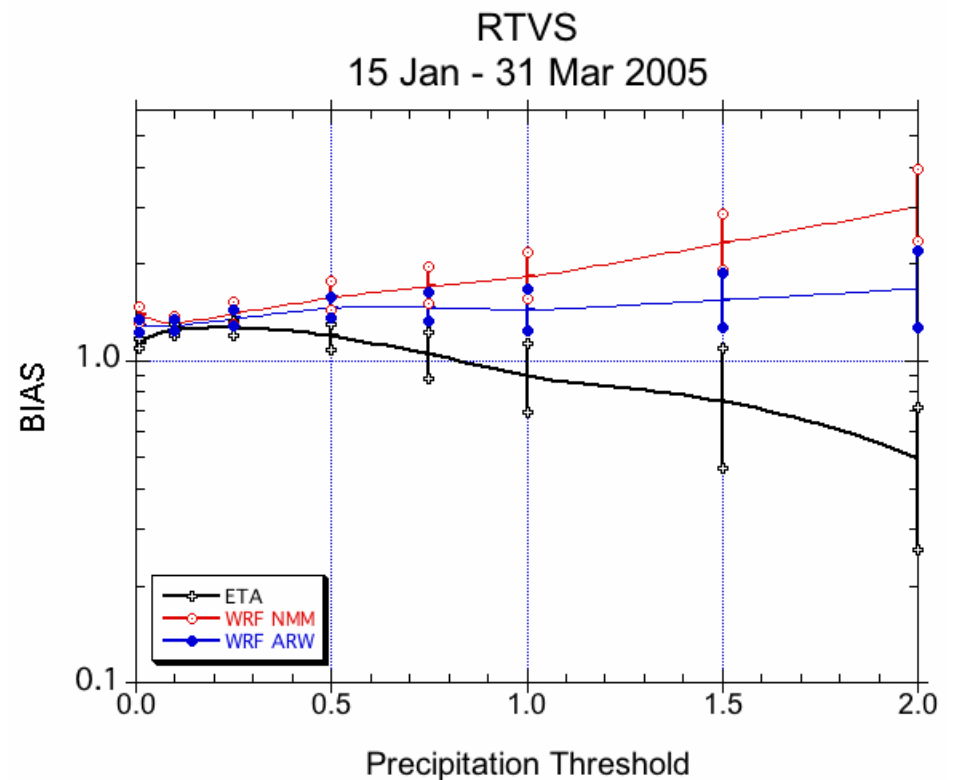
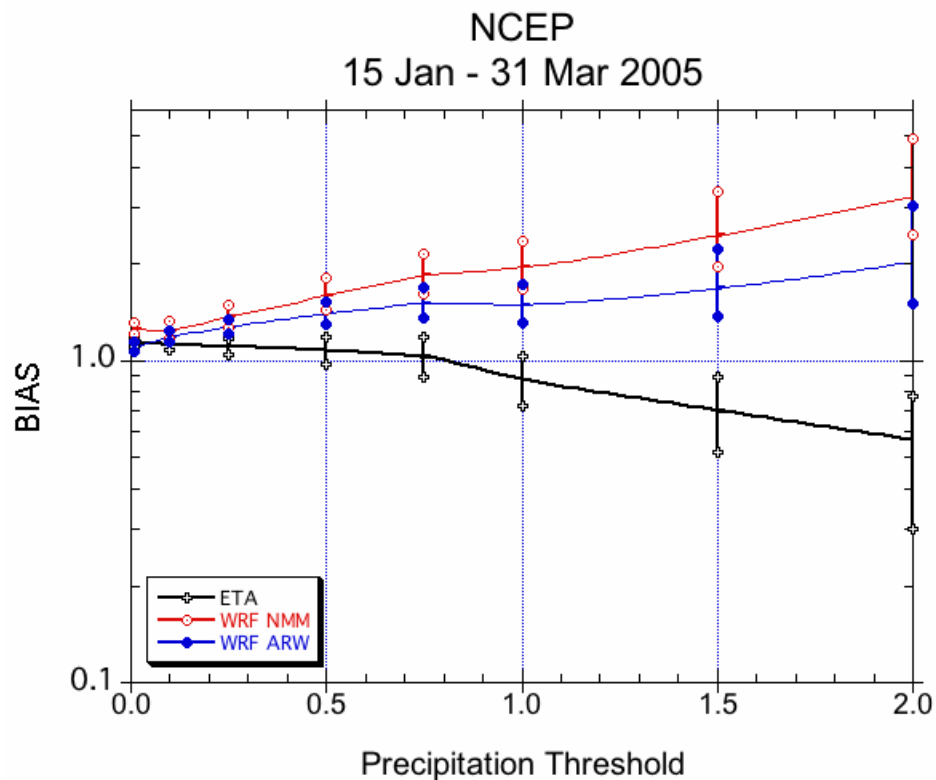
	0.01	0.10	0.25	0.50	0.75	1.00	1.50	2.00
WRF/ARW Bias (RTVS)	1.28	1.28	1.35	1.46	1.46	1.44	1.55	1.68
WRF/MMM Bias (RTVS)	1.39	1.30	1.40	1.57	1.70	1.82	2.32	3.02
Eta Bias (RTVS)	1.13	1.24	1.26	1.19	1.04	0.89	0.74	0.49
WRF/ARW Bias (NCEP)	1.10	1.19	1.28	1.40	1.51	1.50	1.68	2.04
WRF/MMM Bias (NCEP)	1.26	1.24	1.37	1.60	1.84	1.95	2.45	3.26
Eta Bias (NCEP)	1.15	1.12	1.11	1.08	1.03	0.88	0.70	0.57

Direct comparison of results from the two systems



*Comparison of NCEP and RTVS methods for calculating ETS
95% confidence intervals using bootstrapping method are shown*

Direct comparison of results from the two systems



*Comparison of NCEP and RTVS methods for calculating BIAS
95% confidence intervals using bootstrapping method are shown*

DWFE Precipitation Verification Results

- Difference of ETS skill scores between the Eta and the two WRF models was insignificant for all rainfall thresholds.
- WRF-NMM and WRF-ARW models overforecast the areal extent of precipitation amounts in excess of 1" in 24 hours - though less of a problem for the ARW. This might reflect the fact that a convective parameterization scheme was not used, which is known in warm season convective situations to produce too much heavy precipitation.
- Eta model underforecast the areal extent of large precipitation amounts, consistent with the known tendency of Eta to lack detail in its precipitation forecasts.
- NMM and ARW are more similar to each other than to the Eta.

... continued

- RTVS precipitation skill scores in one test for the same 24h accumulation periods were very similar to the results from the NCEP verification system - thus substantiating the fact that RTVS does reproduce the same general results as NCEP.
- Dichotomous forecast verification (ETS, Bias) is not well suited for infrequent events. ETS is unstable at small sample sizes (higher thresholds for precipitation amounts). Addition of confidence intervals to the results addresses this issue. Other kinds of verification methods can provide additional valuable information about **the true value** of high-resolution model forecasts.